

ABSTRACT OF THE INVENTION

A novel chemistry, system and application technique reduces contamination of semiconductor wafers and similar substrates and enhances and expedites processing. A stream of liquid chemical is applied to the workpiece surface. Ozone is delivered either into the liquid process stream or into the process environment. The ozone is preferably generated by a high capacity ozone generator. The chemical stream is provided in the form of a liquid or vapor. A boundary layer of liquid or vapor forms on the workpiece surface. The thickness of the boundary layer is controlled. The chemical stream may include ammonium hydroxide for simultaneous particle and organic removal, another chemical to raise the pH of the solution, or other chemical additives designed to accomplish one or more specific cleaning steps.